DR-15

LACTONES FORMATION DURING MONOSACCHARIDE'S CARAMELIZATION IN ETHANOLIC-AQUEOUS SOLUTIONS

I. S. Cherepanov, O. O. Botalova

Udmurt State University. Universitetskaya St, 1, Izhevsk, 426034, Russia.
E-mail: cherchem@mail.ru

Abstract. Caramelized carbohydrate's products contain ester functions, which are play a significant role in foodstuff properties, but their formation processes are not considered in detail [1]. In present work sugar lactone's fragments in monosaccharide's thermodestruction products structure were identified using FTIR spectroscopy, several characteristic bands were choosing for structural analysis. The bands at 1164 and 1255 cm^{-1} are symmetric and asymmetric stretching vibrations of the –C(=O)–O– C-group respectively. Complex signal with maxima near 1720 cm^{-1}, assigned to C=O stretching vibrations, was resolved using derivative procedures (Figure 1).

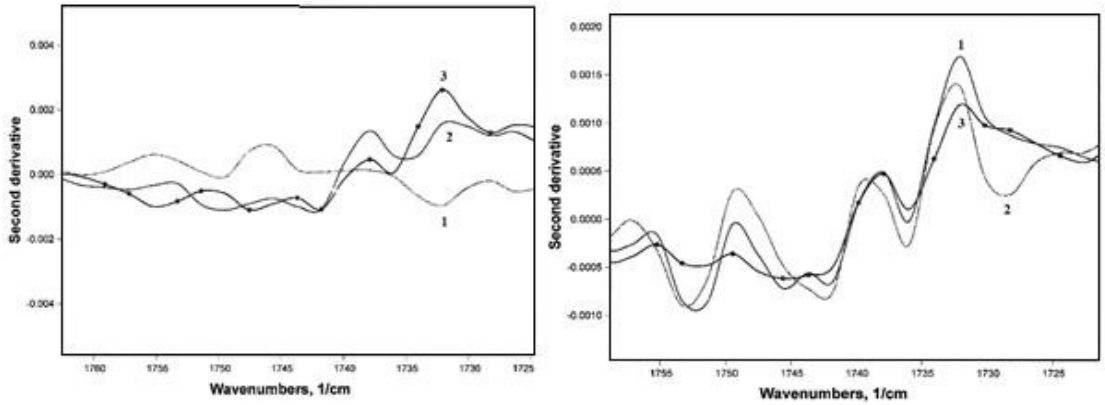
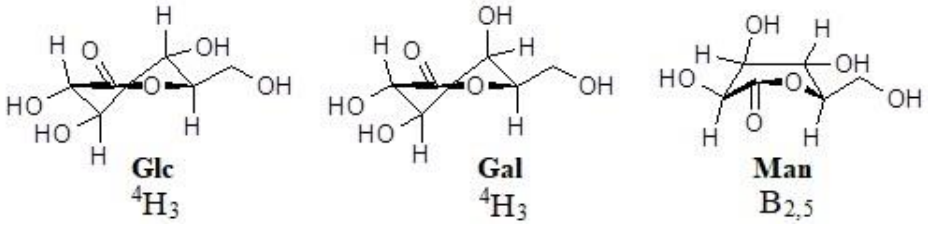


Figure 1. Second derivatives FTIR spectra bands of monosaccharide's caramelized products, synthesized for 1 hour (left) and 1.5 hours (right): 1. – Glc; 2. – Man; 3. – Gal

At 1 hour thermostatting of reaction systems the 1732 cm^{-1} modes, corresponding to $\nu_{C=O}$ in sixmember saturated δ-lactone ring, were recorded for galactose and mannose systems, as soon as at 1.5 hours thermostatting several bands were observed for all systems, illustrating subsequent functionalization. Positive peak at 1750 cm^{-1} appears in the spectra of caramelized mannose only, that is due to monosaccharide's lactones conformation type [2]. For glucose and galactose systems half-chair conformer ($^4H_3$) is suggests as predominant form:



and for mannose system a boat conformation ($B_{2,5}$) was proved as more favorable. Equatorial substituent at C_2 and lactone function in $^4H_3$ are in unfavorable steric interaction [2], leading to further structural transformation [1] and corresponding FTIR bands shift to low frequencies.

References

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2. Bierenstiel M. δ-Galactonolactone: synthesis, isolation, and comparative structure and stability analysis of an elusive sugar derivative / M. Bierenstiel, M. Schlaf // Eur. J. Org. Chem. – 2004. – Iss. 7. - P. 1474–1481.